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ABSTRACT

The University of the Balearic Islands (Spain) has continued in recent years to extend and broaden its efforts in the revitalization of its undergraduate education program. The University's location (it covers three different islands) makes it a particularly appropriate testbed for examining the application of information technologies to undergraduate education. This paper describes a work-in-progress project that has involved implementing and evaluating a computer-assisted personalized approach for homework assignments using the World Wide Web, evaluation tests of students' knowledge background, and computer network-based examinations. Students' feedback and performance are also discussed. (Author/AEF)

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Evaluation of Computer-Assisted Assignments in a Networking Courseware

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Abstract

We describe the work-in-progress project of a software tool to implement and evaluate a computer-assisted personalized approach for homework assignments using the world wide web, evaluation tests of the students' knowledge background, and examinations, currently used in a computer networks course, used for the first time at the University of the Balearic Islands. Due to the university's geographical environment (it covers three different islands), we have a specially appropriate testbed in the field of the application of information technologies to undergarduate education and, in particular, the computer-assisted learning. This short paper describes the first results about the student's rating of the system and performance.

Key-words: distance education, educational multimedia, computer-assisted learning

1 Introduction

The University of the Balearic Islands (UIB) has continued in the recent years to extend and broaden its efforts in the revitalization of the undergraduate education. The project described in this short paper is one of the last initiatives of a whole project, and the work-in-progress is summarized.

It's well-known that students can learn better when they are stimulated by the courseware interactivity and they can follow a personal way to learn. Indeed, some courseware prototypes for the specific field of networking learning have been reported with high interactivity with good results [9]. Two are the main parts of our courseware:

(A) the course's specific material web pages which includes also URL links to related items, links to a lot of solved exercises and problems, links to homework problems, and links to experience questionnaires and knowledge tests, and

(B) a forum of discussion with advanced features, which virtually gives the course as an electronic community. Electronic communities are useful to link geographically-dispersed people, which is a potential field of application in our islands. Nevertheless, as reported in the literature, there are key factors for success in such electronic groups: (1) that the group have a purpose and specific outcome; (2) that at least one person in the group acts as a facilitator; (3) that there is purpose and good reason for convening the group electronically.

Concerning to (A), many web-based courses on networking, with similar instructional material and contents, can be found on the web. But what we want to emphasize in this paper, and it is a fundamental goal of the project, is our interest to study the impact produced on the learning process by the synergy of using the potentialities of a forum in conjunction with conventional material.

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2 General Features of our Approach

Incorporating software engineering methodologies is a critical aspect [5],[7] we are in mind. Also, as computer-science professionals we are leading the project because it is difficult for educators that lack technical background to create sophisticated www -based courses [6]. In particular, the term computer-mediated communications [2] includes, in our context, tools such a web server, video conferencing facilities, and a set of wireless area network (WLAN) devices that allow to access to teacher's lectures and all educational material at the network-wired web, and to the forum, from the classroom, using only a laptop with a wireless device attached with a PCMCIA card, and a portable video projector.

One important limit is the need not to overload the students: questionnaires and interviews in order to learn more have the students limited tolerance for this addition to their time. So that we have kept a compromise between the amount of feedback and the implications of such quizzes on the student performance. The most important criterion in testing is whether the courseware is effective in the sense that students learns from it.

About the task experience questionnaire. Targeting particular skills concerning the background knowledge of the students, it has been useful for us, the teachers, to have some information about the students' previous and current experience in the domain of computer networks. The questionnaires have taken the format of an anonymous test with about fifty rather-basic questions to be selected among four possible answers. The anonymity oh the test was because students were reluctant to reveal their identify, worried about the test's implication on its final grade. Anonymity was guaranteed because this kind of test did not have any grade's implication and was completely different to, and should not be confused with, diagnostic tests to establish individual learning needs, that is the knowledge quizzes.

About knowledge quizzes: the quizzes are constructed similarly to the task experience questionnaire. For consistent marking, the quiz is multiple choice: students should select the correct answer among (usually) four. Two basic kinds of questions were posed which implies: a) the computation of a result and the selection of the suitable answer, and b) the selection of a statement on the basis on the truthfulness or the falseness suggested by the question. The consistency of a question, in the sense that it will be completely understood by the student, has two main implications to be carefully taken into account by the teacher: (a) has no ambiguities, i.e.,. only one is truth or false, depending on the nature of the question, and (b) in the questions with computations, the accuracy of the results has a reasonable degree of tolerance; in other words, and the suggested answers are posed on the basis of either with different order-of-magnitude or with enough numeric 'distancing'.

Each question usually corresponds to a distinct learning objective. The courseware's teachers interface gives automatically the possibility to enter: i) the number of questions of the particular quiz, ii) the text of each question directly or from a questions' database, and iii) the number of suggested answers, one and only one of each is correct, and the corresponding text.

3 Feedback for the Instructors

The large body of literature that exists concerning the design and evaluation of instruction and training systems, and that were though using different distance learning technologies [4]. The three issues addressed, which we are taking into account in our project to evaluate its effectiveness are:

(1) Was the course a success in terms of academic performance and proficiency gains?
(2) Was it successful in terms of student satisfaction?, and
(3) Did the technology support a high level of student interactivity?

The first issue is a virtual standard for evaluating instructional programs; the second issue one may be critical to increase student motivation and to improve its learning. Seven parameters are reported in the literature, to be taken into account in our context to compute the student satisfaction with the: (a) instructor(s); (b) technology (c) course management (d) at-site personnel (d) promptness of material delivery relative to timing of the lectures (e) support services; and (f) out-of-class interaction with instructor(s).

The third issue is, namely, relevant to: (i) the real-time availability of the web server (ii) the student's accessibility to personal computers at the university and/or at home, and (iii) the ergonomics, in the sense of he student's feeling of how easily the courseware interface with the course's material is. About (i) the server is has not already get a 100% of availability due to maintenance tasks, but it will. As far as concerns to (ii), about 180 personal computers are available to students at different sites of the campus. Concerning the point (iii), our efforts are, by the one hand, to use an interface as ergonomic as possible, interacting with students suggestions and, on the other, using an electronic tool for electronic groups.

As far as we have already get some practical experience, each of these factors have a very clear impact in our context. For the forum, the used tool for electronic groups is the AltaVista Forum [8] o create a group or "team" of course's members (students, teachers, and at-site supporting personnel). This application provides a fun and easy way to communicate and to share resources with different groups of people. It means that a student can belong to as many teams (courses) as he is registered: with the forum, he is viewing his own student profile and enters the specific course by clicking on among the list of courses. By now, only the computer networks advanced course is on line, but it's likely expected to be other very different courses during the next academic year 98-99, as experience is gained with our work. Other features make the forum tool very attractive for the computed-assisted learning: every course member can communicate with other people, individually or in a broadcast or multicast form, by posting notes in an on-line conversation, by requesting an appointment with another member of the forum, by having the tool notify members through electronic mail when new information has been added to the forum, and by having on-line conferences in the form of real-time chatting. In addition to this virtual communication channel members can share resources with other by sharing documents, by keeping a course calendar of meetings and events, and by searching Interment news sources and sharing those with others. This is useful both for teachers to get in contact with specific students or to notify the addition of new materials, proposals of dates for new quizzes, etc. and for students to get in contact both with teachers and other students. The forum tool lets members operate in an environment where there is a high level of trust, and because of the number of students of the computer networks course is relatively small (about fourteen), that trust is effectively possible. Nevertheless, teachers and other support-persons have some privileges: they

are able to add or delete members, add and delete each other's documents and discussion notes .

4 Student Performance

In order to analyze the student performance, following partially the method suggested in [3], we are observing the following parameters:

1. The distribution of the solved homework problems in % for the whole class.
2. The average performance in the final exam, in %, as a function of the fraction of homework problems solved, in %.
3. The correlation between the percentage of solved homework problems to percentage correct on the final exam.
4. The total number of logins as a function of time during the course. In particular to observe its correlation with deadlines of homework, test and exams.
5. The average number of solved problems, in %, compared with the actual degree of difficulty, not the *a-priori* difficulty estimated by the teachers, defined by the ratio of number of wrong answers over the number of total answers, for the different homework sets.
6. The degree of difficulty, expressed as the ratio of number of wrong answers over the number of total answers for all of the individual problems (of all homework sets).

5 Concluding Remarks

The term 'evaluation' implies making a judgment; a better statement is "to discover how an educational intervention performs by observing and measuring the teaching and learning process, or some small slice of it [1]. By now, as far as the experience is still new at our university and the course has not finished, no too much information is still available to get reliable conclusions. In the near future, more courses will probably adopt our approach and use our experience, so more refined conclusions are expected to be available and be reported in future papers.

Nevertheless, we have observed that one of the main conclusions found in the literature [1] is applicable to our experience, which is that the main benefit of computer-aided learning is to help teachers make better use of it by adjusting how it is used, rather than by changing the software or informing purchasing decisions.

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